

A significant aspect of the present invention is that the pile anchor head is adapted to receive the building load and transfer it to practically any kind of material and shape of pile without restricting to the common use of steel pipes in underpinning.

According to one aspect of the present invention there is provided an underpinning pile system for lifting and underpinning a settling foundation comprising:

- 10 a pile;
- a transfer beam having an opening for receiving the upper end of the pile, the transfer beam being arranged to engage with the foundation on at least two points, one either side of said opening;
- 15 a pile anchor head receivable in the opening in the transfer beam, the pile anchor head having a hollow section for receiving the upper end of the pile and a portion arranged to engage with the transfer beam adjacent the opening; and
- a jacking means engageable with the transfer beam and the
- 20 upper end of the pile;
- wherein the jacking means exerts a force on the upper end of the pile to drive the pile downwardly relative to the stationary transfer beam.

In another aspect of the present invention, there is provided a method for installing an underpinning pile system for lifting and underpinning a settling foundation characterised by comprising the steps of:

- excavating a hole adjacent to the foundation;
- placing a transfer beam having an opening for receiving the
- 30 upper end of a pile in the excavated hole, the transfer beam being arranged to engage with the foundation on at least two points, one either side of said opening;

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placing a pile anchor head having a hollow section for receiving the upper end of the pile in the opening in the transfer beam such that the pile anchor head engages with the transfer beam adjacent the opening;

- 5 placing a pile through the hollow section in the pile anchor head;

engaging a jacking means with the transfer beam and the upper end of the pile; and

- 10 driving the pile downwardly relative to the stationary transfer beam by operation of the jacking means.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

- Further understanding of the aspects of the present invention and their advantages will be discerned after studying the Detailed Description in conjunction with the  
15 accompanying drawings in which:-

Fig 1 shows an underpinning pile according to one embodiment of the present invention;

Fig 2 shows an underpinning piling system and the auxiliary apparatus;

- 20 Fig 3a shows a typical pile anchor head with optional attachments of triangular wedges and with nuts and bolts at corresponding positions to match a transfer beam;

Fig 3b shows another variation of a typical pile anchor head with a wider out splayed flange and web;

- 25 Fig 4 shows installing two C-channels sides by side on each side of the pile anchor head;

Fig 5 shows the placing of a thrust block into the space between the gap of the parallel C-channels and inserting two large pins into the receiving holes at the ends of the  
30 thrust block just clearing beneath the soffit of the parallel C-channels;

Fig 6 shows the placing of a hydraulic jack over the top of the underpinning pile;

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CLAIMS

1. An underpinning pile system for lifting and underpinning a settling foundation characterised by  
5 comprising:  
a pile;  
a transfer beam having an opening for receiving the upper end of the pile, the transfer beam being arranged to engage with the foundation on at least two points, one  
10 either side of said opening;  
a pile anchor head receivable in the opening in the transfer beam, the pile anchor head having a hollow section for receiving the upper end of the pile and a portion arranged to engage with the transfer beam  
15 adjacent the opening; and  
a jacking means engageable with the transfer beam and the upper end of the pile;  
wherein the jacking means exerts a force on the upper end of the pile to drive the pile downwardly relative to the  
20 stationary transfer beam.
2. An underpinning pile system in accordance with claim 1, characterised in that the pile anchor head includes a locking means for securing movement of the pile relative to the pile anchor head once the pile is driven into  
25 position under a jacking load.

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3. An underpinning pile in accordance with claim 2, characterised in that the locking means comprises an anchor plate securable across the hollow section to bear on top of the pile.
- 5 4. An underpinning pile in accordance with claim 3 characterised in that the pile anchor head comprises a hollow member having a tabular cross section complementary to the cross sectional shape of the pile.
- 10 5. An underpinning pile in accordance with claim 3, characterised in that the cross section of the hollow member is complementary to the shape of the anchor plate such that the anchor plate is secured within the hollow member against the upper end of the pile by welding to inner surfaces of the hollow member.
- 15 6. An underpinning pile in accordance with any one of the preceding claims, characterised in that the portion of the pile anchor head that engages with the transfer beam comprises a plurality of flanges that engage with an underside of the transfer beam.
- 20 7. An underpinning pile in accordance with any one of the preceding claims characterised in that the transfer beam comprises two members secured parallel to and separated from each other to define the opening.

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8. An underpinning pile in accordance with claim 7, characterised in that the members each comprise a C-channel members arranged with open sides thereof oriented in opposite directions.
- 5 9. An underpinning pile in accordance with any one of the preceding claims, characterised in that the jacking means comprises an inverted U-shaped thrust block and a jack, the inverted U-shaped thrust block arranged such that ends of parallel legs of the thrust block extend
- 10 downwardly through the opening in the transfer beam on either side of the pile and engage with the transfer beam, and the jack engages between the upper horizontal member of the inverted U-shaped thrust block and the upper end of the pile to force the pile downwardly
- 15 relative to the thrust block.
10. An underpinning pile in accordance with claim 9, characterised in that the ends of the legs of the inverted U-shaped thrust block are provided with holes to receive locking pins such that when the holes are
- 20 positioned below the transfer beam and the locking pins are inserted through the holes, the locking pins engage with the lower surface of the transfer beam to resist upward movement of the U-shaped thrust block relative to the transfer beam.

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11. An underpinning pile in accordance with claim 10,  
characterised in that the legs of the U-shaped thrust  
block include outwardly extending wedges, the wedges  
engaging with an upper surface of the transfer beam when  
5 the U-shaped thrust block is inserted downwardly through  
the opening in the transfer beam.
12. A method for installing an underpinning pile system  
for lifting and underpinning a settling foundation  
characterised by comprising the steps of:
- 10 excavating a hole adjacent to the foundation;  
placing a transfer beam having an opening for receiving  
the upper end of a pile in the excavated hole, the  
transfer beam being arranged to engage with the  
foundation on at least two points, one either side of  
15 said opening;  
placing a pile anchor head having a hollow section for  
receiving the upper end of the pile in the opening in the  
transfer beam such that the pile anchor head engages with  
the transfer beam adjacent the opening;
- 20 placing a pile through the hollow section in the pile  
anchor head;  
engaging a jacking means with the transfer beam and the  
upper end of the pile; and  
driving the pile downwardly relative to the stationary  
25 transfer beam by operation of the jacking means.

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13. A method for installing an underpinning pile system in accordance with claim 12, characterised by including the step of securing any further movement of the pile relative to the pile anchor head once the pile is driven  
5 into position and loaded with a locking means to engage the pile with the pile anchor head.

14. A method for installing an underpinning pile system in accordance with claim 13, characterised by including the steps of driving the pile downwardly until the upper  
10 end of the pile is within the hollow section of the pile anchor head and inserting an anchor plate into the hollow section to bear on the top of the pile and welding the anchor plate to internal surfaces of the hollow section of the pile anchor head.

15 15. A method for installing an underpinning pile system in accordance with any one of claims 12 to 14, characterised in that engaging the jacking means with the transfer beam and the pile comprises the steps of:

inserting legs of an inverted U-shaped thrust block  
20 downwardly through the opening in the transfer beam such that the legs are positioned on opposite sides of the pile;  
engaging ends of the legs with the transfer beam; and

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inserting a jack between the upper end of the pile and a lower side of a horizontal member of the inverted U-shaped thrust block.

16 A method for installing an underpinning pile system in accordance with claim 15, characterised in that locking pins are inserted through holes provided in the ends of the legs of the inverted U-shaped thrust block when the ends of the legs are located below the transfer beam, such that the locking pins engage with a lower surface of the transfer beam and thereby resist upward movement of the inverted U-shaped thrust block relative to the transfer beam.

17. A method for installing an underpinning pile system in accordance with claim 16 characterised in that the step of driving the pile downwardly relative to the transfer beam comprises the step of extending the jack to force the pile downwardly relative to the thrust block.

18. A method for installing an underpinning pile system in accordance with any one of the preceding claims including the step of securing the pile anchor head to the transfer beam once the pile is driven into position and secured to the pile anchor head.

19. A method for installing an underpinning pile system in accordance with claim 19 characterised by placing a plurality of wedges such that the wedges engage against



the pile anchor head and the transfer beam, and welding  
the wedges to the transfer beam and the pile anchor head.

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**ABSTRACT**

There is disclosed an underpinning pile to provide an efficient, simple and sure method in driving and lifting the foundation and at the same time securing the direct transference of preload without further loss of preload from the building into the newly completed driven pile. A pile anchor head (11) is provided that receives a pile (12) and is provided with a lifting means (13). The pile anchor head (11) and lifting means (13) receive the building load and transfers it to the pile (12), which allows practically any kind of material and shape of pile (12) to be used.

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